

RESEARCH, DEVELOPMENT & TECHNOLOGY TRANSFER QUARTERLY PROGRESS REPORT

Wisconsin Department of Transportation
DT1241 02/2011

INSTRUCTIONS:

Research project investigators and/or project managers should complete a quarterly progress report (QPR) for each calendar quarter during which the projects are active.

WisDOT research program category: <input type="checkbox"/> Policy research <input type="checkbox"/> Other <input checked="" type="checkbox"/> Wisconsin Highway Research Program <input type="checkbox"/> Pooled fund TPF#		Report period year: 2012 <input checked="" type="checkbox"/> Quarter 1 (Jan 1 – Mar 31) <input type="checkbox"/> Quarter 2 (Apr 1 – Jun 30) <input type="checkbox"/> Quarter 3 (Jul 1 – Sep 30) <input type="checkbox"/> Quarter 4 (Oct 1 – Dec 31)
Project title: Predicting Scour of Bedrock in Wisconsin		
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WisDOT project ID: 0092-12-07	Other project ID:	Project start date: 11/1/2011
Original end date: 5/1/2013	Current end date: 5/1/2013	Number of extensions: 0

Project schedule status:

☒ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Project budget status:

Total Project Budget	Expenditures Current Quarter	Total Expenditures	% Funds Expended	% Work Completed
94989	100	0	0	7

Project description:

The objective of the research is to assess the ability of the newly developed NCHRP 24-29 to characterize the scour for various types of Wisconsin bedrock at selected structures throughout the state. The study will evaluate the need to refine the test procedures and establish a range of typical values of the test parameters for Wisconsin bedrock. The research will also compare the new method to current practice and communicate the potential benefits that can be realized through WisDOT implementation.

The proposed study described hereinafter will directly follow the objectives specified in the RFP from WHP:

1. We will collect geologic and hydrologic data from selected sites in Wisconsin where bridges are founded on bedrock.
2. We will conduct field and laboratory test to establish parameters that characterize the relationships between the bedrock erosion rate and the hydraulic loading, following methods developed for the NCHRP Project 24-29.
3. We will refine the test procedure and establish models that include a range of parameters specific for Wisconsin bedrock. We will apply the new models to more accurately predict rock scour at Wisconsin bridges.
4. We will also compare the new model to current practice and communicate the potential benefits that can be realized through WisDOT implementation. Final results will be incorporated into the current WisDOT Bridge Manual with additional procedures for bridge scour analysis.

Progress this quarter (includes meetings, work plan status, contract status, significant progress, etc.):

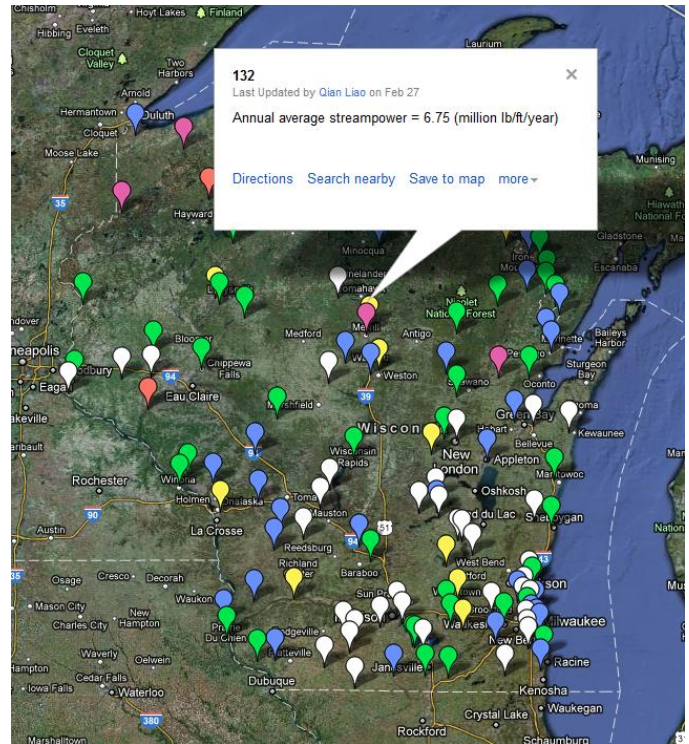
Performed hydraulics and hydrology analysis:

In order to facilitate the process of locating field test sites, we have conducted thorough review and analysis on hydraulic parameters of major Wisconsin rivers and streams. Specifically, we have estimated the average stream power based on available

hydrological data. We have identified streamflow stations in Wisconsin (232 sites in total) as listed on the webpage http://waterdata.usgs.gov/wi/nwis/current?type=flow&group_key=NONE . We have developed programs (in Matlab) to automatically extract historical daily stream flow data, field calibration data, annual peak flows and annual statistics. Based on extracted data, we have applied regression analysis on stage rating data to establish the relation between the water depth (y) and discharge, and the relation between the mean velocity (V) and discharge (power law relation). Stream power based on daily averaged flow is then calculated using the equations

where γ is the specific weight of water (62.4 lb/ft^3) and the Manning's roughness n is chosen to be 0.032 as a representative to natural streams, while this value could be changed in the future when field survey is conducted. A preliminary map is created (Google map kml file) to present the locations of all stream stations and the associated annual mean stream power. This map will be applied along with geological analysis to selected field sampling sites based on the level of stream power and the erodability of rocks.

The hydraulic and hydrological analysis is ongoing: we are developing programs to improve the prediction of stream power based on flood events using the frequency weighted analysis. We will compile results to produce a database of stream power analysis for Wisconsin rivers.



Anticipated work next quarter:

Continue literature review

Continue analysis of hydraulics and hydrology data and link locations to rock types to establish potential locations for field testing

Coordinate with WisDOT the identification of potential field projects

Start field work and laboratory testing

Circumstances affecting project or budget:

None

Attach / insert Gantt chart and other project documentation

Year		2011	2012				2013
Task		Q4	Q1	Q2	Q3	Q4	Q1
1	Literature Review						
2	Selection of Test Locations						
3.1	Laboratory Testing						
3.2	Field Testing						
3.3	Modeling						
6	Final Report						

 Proposed

 Current

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Staff receiving QPR:	Date received:
Staff approving QPR:	Date approved: